XMM-Newton CCF Release Note

XMM-CCF-REL-160

OM PSF

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1 CCF components

Name of CCF	VALDATE	List of Blocks changed	CAL VERSION	XSCS flag
OM_PSF1DRB_0008	2000-01-01T00:00:00	PSF-U		No
		PSF-B		No
		PSF-V		No
		PSF-UVW1		No
		PSF-UVM2		No
		PSF-UVW2		No

2 Changes

This CCF file provides a new measurement of the OM UV PSFs. Since most of the sources in the UV filters are relatively faint, only a single PSF has been available for each of the UVW1, UVM2, and UVW2 filters in the previously existing CCF. Alice Breeveld (MSSL) has analysed several very crowded fields and now derived the UV PSFs for different count-to-framerate ratios (CFRRs).

3 Scientific Impact of this Update

These new PSFs have been derived from in-flight data on stars of a wide range of brightnesses, taking coincidence loss and CFRR into account. This update will improve the accuracy of the OM UV photometry.

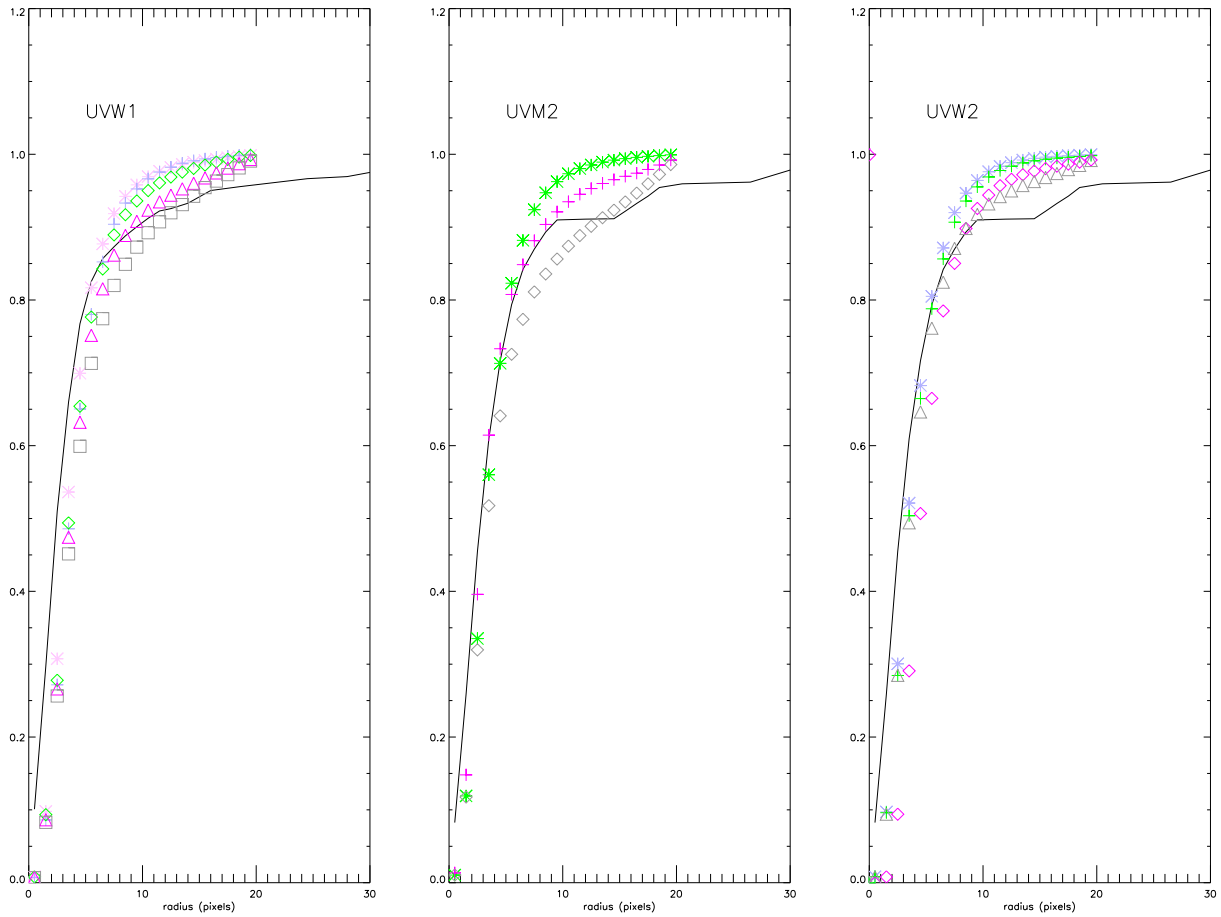

Figure 1: Growth curves as a function of radius for PSFs in the UVW1, UVM2, and UVW2 filters, respectively. The solid lines are the old PSFs, and the symbols trace the new PSFs. The different symbols represent the different CFRR groups.

4 Estimated Scientific Quality

In Figure 1, we show the growth curves as a function of radius (in pixels) for, respectively, the UVW1, UVM2, and UVW2 filter PSFs. (For OM, one pixel is about 0.48 arcsec). The solid lines are the old PSFs, and the symbols trace the new PSFs. The different symbols from the new PSFs represent the different CFRR groups. There are 5 CFRR groups for UVW1, 4 for UVW2 and 3 for UVM2. For example, the asterisks and diamonds represent the brightest and faintest star groups for the UVM2 filter.

There is a clear trend to narrower PSFs for brighter stars. The PSF widths for the UV filters do not increase with an increase in energy as expected. The UVW2 and UVW1 cases seem very similar, with the UVM2 PSF possibly being slightly narrower.

While this new CCF is stable and sufficiently good, a field-position-dependent PSF canot be made with available data. Therefore, these new PSFs are field-position-independent.

5 Test Procedures

This new CCF has been tested using SAS version 5.4.1. SAS omichain tasks have been run through several ODFs with different modes and no error message has been detected.

In order to check the influence of the new PSFs on the final count rates, two tests described in the next section have been made to compare the count rates derived from the old (om_psf1drb_0006.CCF) and new (om_psf1drb_0008.CCF) PSFs for the calibration star GD153 (test 1) and all stars in another calibration field in full frame mode (test 2).

6 Summary of the test results

6.1 Test 1:

The observation used is of an OM calibration target, GD153 in rev. 561. In Table 1, the measured count rates in the UVW1, UVM2, and UVW2 bandpasses are given. It can be seen that the count rates with the new PSFs are smaller than those with the old PSFs.

Table 1: The count rates for white dwarf GD153 using the old and new UV PSFs.

Filter	Old PSFs	New PSFs
UVW1	343.058	323.944
UVM2	167.119	147.580
UVW2	86.334	79.977

For the UV filters, XMM-Newton SAS measures counts, corrected for coincidence loss within a 12 pixel aperture, then extrapolates the counts to a radius of 35 pixels using the PSF files. The smaller counts with the new PSFs in Table 1 arise because the new PSFs are narrower, thus the aperture correction is smaller. The results are what we have expected.

6.2 Test 2:

A calibration observation from rev. 705 has been used. SAS has detected 2113, 256 and 166 sources for UVW1, UVM2 and UVW2 respectively. Since the field is crowded in the UVW1 filter, we first consider the results for the UVM2 and UVW2 filters. In Figure 2, the relative difference in the count rates refers to the difference between the count rates measured with the old PSF and the new PSF, divided by the count rates measured with the old PSF. It can be seen that the relative difference in the count rates has 2 values for UVM2 and 4 values for UVW2, depending on the brightness of the sources. This is because the new PSF is CFRR dependent, including several different CFRR groups (see Figure 1).

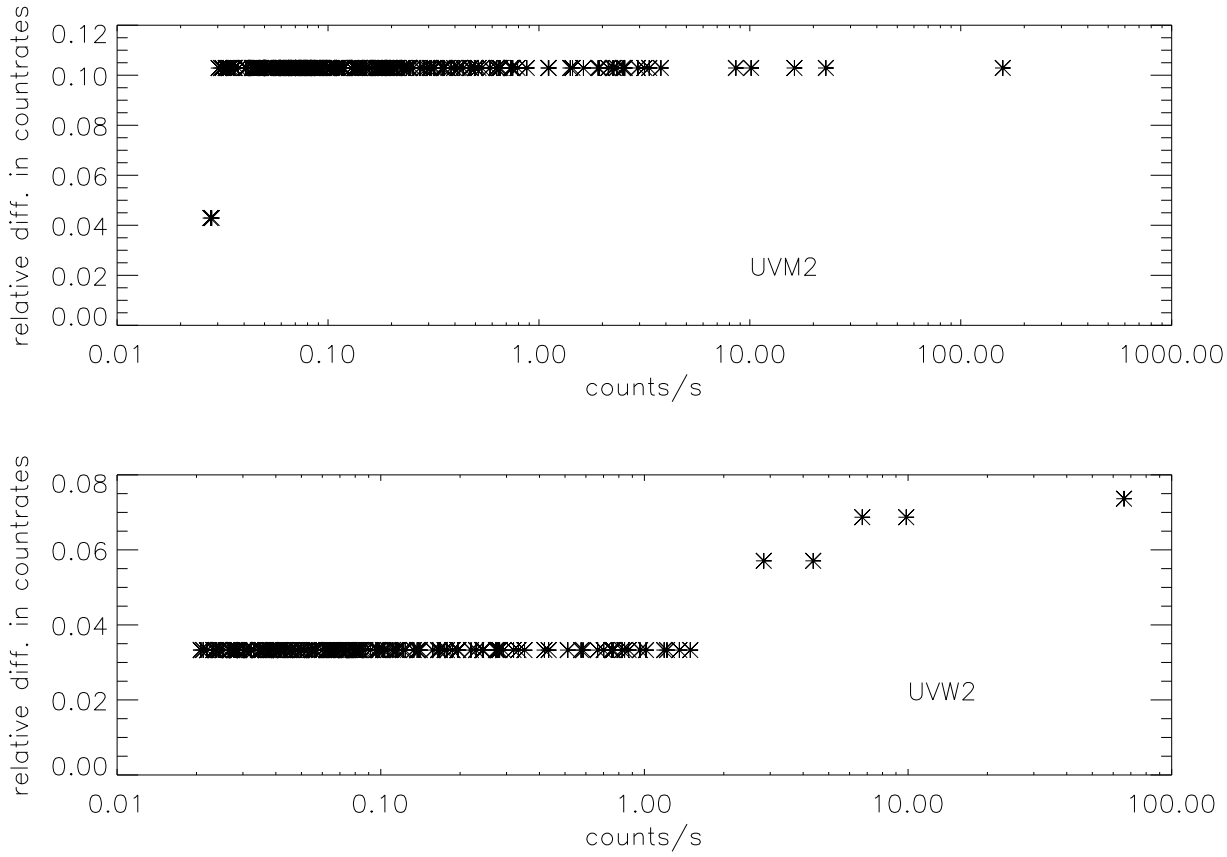

Figure 2: The relative difference in the count rates (see text for details) as a function of the count rates for the UVM2 and UVW2 filters.

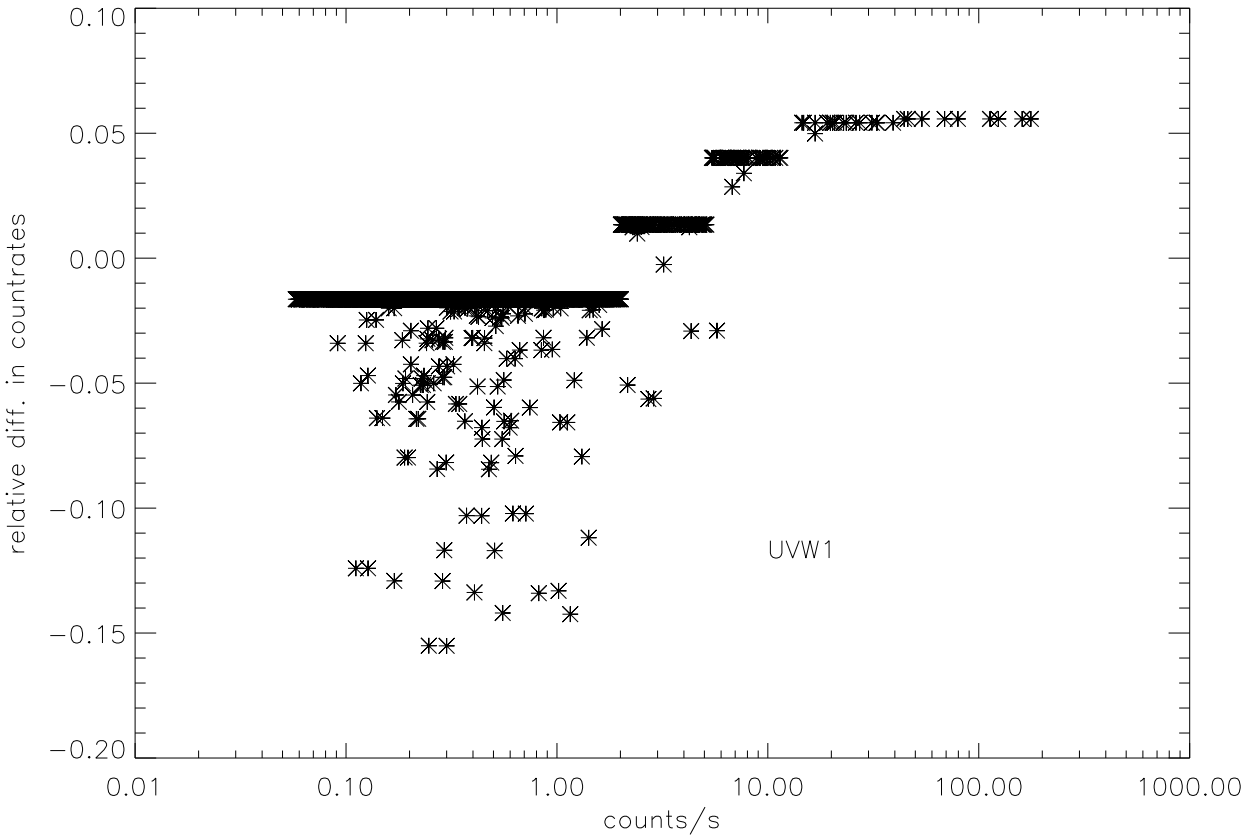

Figure 3: Same as Figure 2, but for UVW1 filter.

For UVW1, the situation is more complicated. Since the field is crowded, in some cases we cannot use the default aperture radius (12 pixels) as was done above for UVM2 and UVW2, a smaller aperture radius has to be used. The background-subtracted counts at first are extrapolated, using the PSF, to the coincidence-loss area corresponding to a circle of 12 pixels. A correction is made for coincidence-losses. Then a further correction is made (as in the case of UVM2 and UVW2) to extrapolate the counts to a radius of 35 pixels using the PSF again. In Figure 3 the sources which do not lie on the horizontal lines are processed using a smaller aperture radius. All results show that this new CCF has been updated correctly.

7 Expected Updates

It is felt that a further update for UV PSFs will not be needed soon unless the OM response changes significantly. However, current OM throughput (fudge factors) and zero-points are based on the measurement of GD153 and several other white dwarfs, using the old PSFs, so all of them need to be revised soon using the new PSFs.

8 Acknowledgements

Thanks to OM team members, especially Alice Breeveld (MSSL) for her inputs.